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## PSYCHOLOGY AND PHYSIOLOGY.

*Grundzüge der physiologischen Psychologie.* Von Wilhelm Wundt. 5th edition. Vols. ii. and iii. Pp. viii+865, ix+796 and 133; and Gesamtregister. (Leipzig: Engelmann, 1902-3.) Prices 13s., 14s., and 3s.

*Principles of Physiological Psychology.* By Wilhelm Wundt. Translated from the fifth German edition by E. B. Titchener. Pp. xvi+347. (London: Swan Sonnenschein and Co., Ltd., 1904.) Price 12s.

WITH these two volumes Prof. Wundt concludes what in all probability is the last edition of this great work prepared by his own hand. The single volume of the first edition of 1874 is now expanded to three large volumes comprising 2168 pages. Founded, as it is, chiefly upon the author's own researches and those of his pupils, the treatise forms a splendid monument to his life-long labours in a field in which he has been for long a pioneer and the most prominent figure.

The main part is an expansion and development of the views expounded in earlier editions in accordance with the data that have accumulated so rapidly in recent years. For, as Wundt points out, psychology has now happily achieved methods of research by which any intelligent and industrious worker may add something, however small, to the mass of empirical data on which the future science is to be built up, and in so doing has assured its place among the progressive sciences. To this edition a final section is added, in which the veteran thinker sets forth his matured conclusions on the general principles of psychology and on its relations to other sciences. To the exposition of one of the most important of these principles this article may profitably be devoted. Not many years ago most writers who discussed the functions of the brain postulated what they called a *sensorium commune*, a central nervous organ or "centre" in which the afferent nerves of all the sense-organs were supposed to come together, and to the substance of which each such nerve was supposed to communicate its specific mode of activity, generally assumed by those writers to be some peculiar form of molecular vibration. It was supposed, therefore, that when two or more sensory nerves of different functions are simultaneously stimulated, this "centre" becomes the seat of a complex resultant physical process, embodying the specific characters of the two or more kinds of neural process. And this hypothetical physical resultant was held to be the immediate correlate or excitant of the complex affection of consciousness. In this way it was sought to explain the unitary character of the state of consciousness resulting from the simultaneous stimulation of different sensory nerves. To every part of the brain that is median and therefore has no symmetrically disposed duplicate, this position of honour has been assigned by one or other writer—to the pineal gland by Descartes, to the pons by Spencer,

to the basal ganglia in general by Maudsley and Carpenter, to the *septum lucidum* and to the third ventricle by others, to some undefined region by Herbart and Lotze. Under the powerful impulse of this supposed necessity others, notably G. H. Lewes, E. v. Hartmann and Ed. Montgomery, have made the whole brain the *sensorium commune*, assuming that the specific mode of vibration initiated in each kind of sensory nerve thrills throughout the whole or the greater part of the mass of the brain.

In the *Psycho-physik* (1860) Fechner clearly exposed the untenable character of all such assumptions and showed that "the psychically unitary and simple are resultants from physical manifolds, the physically manifold gives rise to a unitary or simple (psychical) resultant." This principle was accepted by Helmholtz, and by Lotze in his later writings; and the progress of our knowledge of the brain achieved since that time has made patent to all the impossibility of assigning the psycho-physical processes, the processes immediately correlated with psychical processes, to any one part or "centre" of the brain.

Nevertheless, in dealing with concrete instances of unitary psychical resultants from multiple sensory stimulations, as in the case of the compound colour sensations or of the fusion of the effects of stimuli applied simultaneously to corresponding areas of the two retinæ, many, perhaps most, physiologists and psychologists still postulate a fusion of the underlying neural processes to a unitary physical resultant. It is more difficult to refute this view in such special cases than to prove the erroneousness in principle of the conception of a *sensorium commune*, but fortunately Prof. Sherrington's recent research on the functional relations of corresponding retinal points<sup>1</sup> demonstrates in the clearest manner the separateness of the physiological effects in the brain-cortex of stimuli simultaneously applied to corresponding retinal areas, the instance of fusion of effects to which the doctrine of physiological fusion has been most confidently and plausibly applied; and many pathological and experimental observations bear out this view, both in this case and in other similar cases of fusion of effects of sensory stimuli. The principle laid down by Fechner in the words quoted above may therefore be regarded as well established. This principle Wundt adopts, and he extends its application in a thorough-going manner to the relations of neural and psychical processes in general. Assuming that every "psychical element" is related in a constant manner to an accompanying neural process, he asks (vol. iii., p. 775), Is there any corresponding constant relation between the connections (*Verbindungen*) of those elements and the connections of these processes? "It goes without saying that this question must be answered affirmatively in the sense that to all the psychical elements that are comprised in a complex affection of consciousness, the corresponding physical processes must also be given in simultaneous connection." But that is by no means to say that these physical correlates will constitute a unitary resultant, which would correspond to the psychical resultant. "The complex psychical

<sup>1</sup> See *British Journal of Psychology*, part i. 1904.

formations are further removed from their physiological correlates (than the psychical elements), and this removal is greater the more complex the psychical compounds become. And it is just at this point that psychology as an independent science in the proper sense of the word takes up its task." That is to say, it is the task of psycho-physics to discriminate the elements of our psychical processes and to discover their physiological correlates, but it is the task of psychology proper to discover the purely psychical laws of the synthesis of these elements—a task which would remain to be carried out, though the workings of the brain "stood as clearly exposed to our eyes as the mechanism of a watch."

Wundt then formulates four such fundamental psychical laws or principles, of which the first and most important is the "principle of creative resultants," the principle "that the product arising from any number of psychical elements is more than the sum of those elements . . . it is a new formation incomparable in all its essential attributes with the factors that contribute towards it." So "a clang is more than the sum of its partial tones." "In the same way every spatial percept is a product in which certain elements (the local signs) have yielded up their independence to impart to the product an entirely new property, namely, the spatial ordering of the sensations. In binocular vision the separate images of the two organs of vision disappear, to give rise in the common resultant image to the immediate perception of solidity and depth." On the other hand, the neural correlates of these elements remain a spatially ordered manifold, exhibiting no corresponding fusion or synthesis. The acceptance of this principle is of the first importance for the progress of physiological psychology, but whether it is compatible with adhesion to the doctrine of psycho-physical parallelism, as Wundt maintains, may be seriously questioned, as also whether it can properly be called a principle of psychical causation. It seems clear that if with Wundt we recognise this and the other psychical laws that he formulates, whether or not we admit them as principles of psychical causation, we cannot maintain the principle of psycho-physical parallelism in the rigid form in which it is so widely current at the present time.

It is a pleasure to welcome the appearance of the first part of an English translation of this great work. Prof. Titchener has accomplished this part of his difficult task with all the care and skill which his previous labours in this line have prepared us to expect.

In spite of the title of this work, it is as much a treatise on experimental as on physiological psychology, and in view of the common misconceptions of the relations of experimental to other methods in psychology the following quotation may fitly conclude this brief notice:—"We now understand by 'experimental psychology' not simply those portions of psychology which are directly accessible to experiment, but the whole of individual psychology. For all such psychology employs the experimental method: directly, where its direct use is possible; but in all other cases indirectly, by availing itself of the general

results which the direct employment of the method has yielded, and of the refinement of psychological observation which their employment induces."

W. McD.

#### RADIUM AND RADIO-ACTIVITY.

*Radium Explained.* By Dr. W. Hampson, M.A. (Jack's Scientific Series.) Pp. x+122. (Edinburgh and London : T. C. and E. C. Jack, 1905.) Price 1s. net.

THIS little book, which is sold for the modest price of one shilling, will, we think, serve a useful purpose in giving an elementary acquaintance with the subject of radio-activity, so far as that is accessible to those with little scientific knowledge. The explanations given of the experimental properties of radium are, so far as we have observed, clear and accurate, and the get-up of the book, though not superb, is respectable. Probably one of the most valuable chapters in the book is that on the medical aspects of radium, and its possible uses in the cure of disease, for few writers on radio-activity generally are competent to discuss this part of the subject. Dr. Hampson is of opinion that the medicinal value of mineral waters is connected with their radio-activity. This question, we think, should easily be susceptible of a definite and conclusive answer. There would not be the slightest difficulty in giving baths of weak radium solution more potent by far than the richest mineral waters. Why not test the medicinal value of these? It is really urgent that this experiment should be tried by competent hands.

It is, we think, to be regretted that Dr. Hampson has plunged into an attack on modern views of the constitution of matter, as expounded by Prof. J. J. Thomson, Sir Oliver Lodge, and others. We have read these criticisms with the attention due to a worker like Dr. Hampson, who has done good service in the cause of science, but cannot admit that they possess any validity. To go fully into the questions which he raises would take us beyond the limits of this notice, but we may briefly discuss one or two of the points. At the outset, Dr. Hampson objects to the definition of mass by means of inertia. Mass, he says, is quantity of matter; inertia is dependent on velocity as well as on mass.

It is true, no doubt, that the definition of mass as quantity of matter may be found in some old-fashioned text-books of repute. But such a definition has no value, for how is the quantity of matter to be ascertained? The choice practically lies between defining mass by inertia at a given speed or by gravity. So far as is known, exactly the same ratio between two masses of ordinary matter will result, whichever method of comparison is adopted. As, however, gravity depends on local circumstances, while inertia (at given velocity) does not, the latter property is preferred for the definition of mass, as being more fundamental.

No doubt, before it can be granted that the electron theory fully accounts for the observed properties of matter, it will be necessary to show that it will explain the phenomena of gravitation. This, at present, it